WARNING
This procedure will erase the ACU NVRAM database. This includes site data, antenna parameters, the target data base, and OPT solutions.

PURPOSE

This General Dynamics SATCOM Technologies (GDST) procedure describes the steps for upgrading of 7200/7205/7210 ACU firmware onto FORCE CPU-30Lite Rev4 VME boards, using the Version 3 FLASH command to copy an image from a PC.

SCOPE

This operational procedure is applicable when upgrading factory installed Version 3 firmware on the 72xx family of Antenna Control Units (ACU) for the following:

- Field upgrades of CPU-30Lite Rev4 ACU firmware.

NOTE
This procedure may ONLY be used to upgrade CPU boards with running Version 3.XX ACU firmware. ***V2.xx does not provide support for the FLASH command***

EXPORT CONTROL WARNING
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PERSONNEL RESPONSIBLE FOR IMPLEMENTATION

Manufacturing, Project Engineering, Field Services, R&D departments as necessary, and site Maintenance Engineers upon GDST recommendation only.

To successfully complete this procedure you must be familiar with the terminal software on your laptop or PC and have a working knowledge of the GDST ACU product you need to program, particularly the type of CPU board used.

DESCRIPTION

This procedure describes the steps required to upgrade a FORCE CPU-30Lite Rev4 board, using the Version 3 FLASH command to copy an image from a PC. The CPU-30Lite Rev4 has 4 Mbytes of FLASH memory for use as System PROM, mapped to the following VME addresses:

$FF00 0000 ... FF0F FFFF --- FLASH Bank 0 (bootable)
$FF10 0000 ... FF1F FFFF --- FLASH Bank 1
$FF20 0000 ... FF2F FFFF --- FLASH Bank 2
$FF30 0000 ... FF3F FFFF --- FLASH Bank 3

In factory a "bootable" firmware image is programmed on Bank 0 (the first Mbyte of FLASH). The Version 2-firmware images are 512 Kbytes and the Version 3-firmware images are 640 Kbytes in size.

The method described in this procedure requires an operational ACU system running Version 3 firmware and with a RS232 serial port available to configure as a Menu Tree Remote M&C shell (MT M&C).

Some preparation and planning must precede the execution of this procedure. As a minimum, you will need to obtain the following:

- a binary image (electronic file) of the firmware you need to duplicate.
- The equipment described below (and this procedure).

The above preparation should be coordinated with the R&D department personnel at General Dynamics SATCOM Technologies.

WARNING
This procedure will erase the ACU NVRAM database. This includes site data, antenna parameters; the target data base, and OPT solutions.

The effects of using this procedure include the **TOTAL LOSS of NVRAM data, including all user parameters of the ACU and tracking databases.** Therefore you must plan to record all user parameters BEFORE executing this procedure, and then re-enter them as necessary once the new ACU firmware is operational. For that purpose a worksheet is provided to facilitate recording the user parameters. This is extremely important in the case of upgrades to ACU systems already in service.

TECHNICAL SUPPORT

Read over the following procedure before attempting to program your CPU. If there are any questions concerning this procedure, or technical support is needed, please contact General Dynamics SATCOM Technologies at (903) 295-1480 or send a fax to the attention of the Technical Support department at (903) 295-1479 or via email at vertexrsi@gdsatcom.com (Website is www.gcdsatom.com).

EQUIPMENT REQUIRED

- Phillips screwdriver for #10-32 screws
- Phillips screwdriver for #6-32 screws
- Small flat blade screwdriver
- Anti-static mat with cord to clip to ground point and wrist strap
- A GDST 72XX ACU with V3.00 firmware or higher (V2.xx does not provide support for the FLASH command.)
- Laptop or PC with available serial port and terminal software (i.e. Tera Term, ProComm, HyperTerminal, etc.) capable of binary data transfers using Xmodem with CRC checksums.
- The laptop or PC must have the binary image (electronic file) of the upgrade on a hard disk (not a floppy drive).
- An RS-232 serial communication cable. The pin out of the interconnecting cable must be set up as follows:

D-sub 9-pin female Connect to PC	D-sub 9-pin male Connect to CPU	Modular wire color
3	2	Black
2	3	Yellow
5	5	Green

PROCEDURE

1. Record all user parameters in ACU NVRAM using the following worksheet:

SITE DATA PARAMETERS	
PARAMETER	**VALUE**
Antenna Name	
E. Longitude of site [deg]	
N. Latitude of site [deg]	
Site altitude [meters]	
Timezone offset	
Timezone abbreviation	

POSITION ENCODER CONFIGURATION PARAMETERS			
PARAMETER	**AZ**	**EL**	**POL**
Encoder direction			
Current position [deg]			
Offsets [deg]			
Encoder type			
2-speed internal alignment (Only in systems with Encoder type set to 2-speed resolvers.)			

STEPTRACK DEFAULTS		
PARAMETER	**DEFAULT**	**VALUE**
Cycle time	00:02:00	
Receive -3 dB beamwidth [deg]	0.45	
Step size [deg]	0.040	
Position deadband [deg]	0.040	
Maximum no. of cycles	4	
Cycle to start rate estimates	3	
Peaking correction limit (%BW)	30	
Weight adjustment value	1.00	
Low tracking signal level [dB]	-10.00 dB	
Signal threshold [dB]	15.00 dB	
Axis to peak first	Elevation	
# of samples	30	
Sun outage protection	Enabled	

TRACKING RECEIVER SETUP	
PARAMETER	**VALUE**
Frequency	
RF input	
Attenuation [dB]	
Receiver controller	
0 dB setting	
A/D slope	

MOTION LIMITS PARAMETERS		
PARAMETER	**DEFAULT**	**VALUE**
Soft limits	Enabled	
Lower/CCW soft limits [deg]	AZ: 160.00 EL: 0.00 POL: -90.00	
Upper/CW soft limits [deg]	AZ: 280.00 EL: 90.00 POL: 90.00	
Motion errors	Disabled	
Immobile/reversed timeout [ms]	AZ: 2000 EL: 2000 POL: 2000	
Immobile/reversed tolerance [deg]	AZ: 0.02 EL: 0.02 POL: 0.20	
Runaway angle [deg]	AZ: 0.1 EL: 0.1 POL: 0.2	
Velocity error timeout [ms] (Used only for dc/ac flux vector motor control.)	AZ: 2000 EL: 2000	
Velocity error tolerance [%] (Used only for dc/ac flux vector motor control.)	AZ: 20 EL: 20	

POSITION LOOP PARAMETERS			
PARAMETER	**VALUE**		
	AZ	**EL**	**POL**
Gain crossover [1/sec*1000]			
Integral break [1/sec*1000]			
Filter break [rad/sec*1000]			
Velocity limit [deg/sec]			
Acceleration limit [deg/sec^2]			
Positioning deadband [deg]			
Velocity deadband [deg/sec]			
Jacksaver			
Track -> stop coast time [ms]			
Inching on time [ms]			

ADDITIONAL POSITION LOOP PARAMETERS (AVAILABLE IN SYSTEMS WITH AUXILLARY DRIVES)	
PARAMETER	**VALUE**
Slew rate	
Slew -> track transition [deg]	
Slew -> stop coast time [ms]	

RF/Geometry PARAMETERS	
PARAMETER	**VALUE**
Polarization axis	
Antenna droop correction	
Amplitude droop corr. [deg]	
Elevation alignment [deg]	

REMOTE PORT CONFIGURATION				
PARAMETER	Port 1	Port 2	Port 3	Port 4
Port				
bps (baud)				
Parity				
Data bits				
Stop bits				
Shell				
Echo				
Newline				
Checksums				
Screen lines				

INTERFACE OPTIONS SETTINGS		
OPTION	**DEFAULT**	**VALUE**
UTC display	On	
Local time display	On	
UTC date format	dd Mmm	
Local date format	dd Mmm	
Tracking signal display	On	
Signal units	dB	
User level display	On	
Confirm tracking	On	
Confirm edits	On	
Warning bell	On	
Audible alarm	On	
Monitor can [STOP]/[RESUME]	YES	
Monitor can clear defaults	YES	
YES/NO default answer	YES	
Always show target position	NO	
Command angle display	Position	

The following parameters are only available on 7210 systems configured for Monopulse tracking (not applicable to 7200 and 7205 ACUs).

MONOPULSE GLOBAL PARAMETERS		
PARAMETER	**DEFAULT**	**VALUE**
Nominal gain value	200000	
Maximum rotation value	45.0	
Maximum gain ratio	1.000	
Negate RF Input 1 error(s)	e1: Disabled e2: Disabled	
Negate RF Input 2 error(s)	e1: Disabled e2: Disabled	
Error coupler rotation correction	Disabled	
Rotation direction	Forward	
Direct position control	Disabled	
Gain multiplier	0.60	

Since all target data will be lost, it may also be useful to record target data, depending on the operational mode of the antenna system prior to the upgrade.

TARGET PARAMETERS			
PARAMETER	**TARGET 1**	**TARGET 2**	**TARGET 3**
Target name			
Tracking Mode			
Box Center Longitude [deg E]			
Longitude range [deg]			
Estimated inclination [deg]			
Box limit			
Orbit scan			
Frequency [MHz]			
RF input			
Attenuation [dB]			

TARGET STEPTRACK PARAMETERS

PARAMETER	DEFAULT	TARGET 1	TARGET 2	TARGET 3
Cycle time	00:02:00			
Receive -3 dB beamwidth [deg]	0.45			
Step size [deg]	0.040			
Position deadband [deg]	0.040			
Maximum no. of cycles	4			
Cycle to start rate estimates	3			
Peaking correction limit (%BW)	30			
Weight adjustment value	1.00			
Low tracking signal level [dB]	-10.00 dB			
Signal threshold [dB]	15.00 dB			
Axis to peak first	Elevation			
# of samples	30			
Sun outage protection	Enabled			

OPT PARAMETERS				
PARAMETER	**DEFAULT**	**TARGET 1**	**TARGET 2**	**TARGET 3**
Cycle time with ST solution	00:10:00			
Cycle time with LT solution	00:20:00			
Signal fluctuation limit [dB]	0.20			
Min. ST solution time span [hrs]	1.25			
Min. LT solution time span [hrs]	18			

ADVANCED OPT PARAMETERS				
PARAMETER	**DEFAULT**	**TARGET 1**	**TARGET 2**	**TARGET 3**
ST discard point	0.10			
LT discard point	0.09			
dB collect cycle time [ms]	500 ms (0.5 sec)			
Propagator cycle time [ms]	1000 ms (1 sec)			
Max solution RMS	0.10 (10% beamwidth)			
Max steptrack fit [db]	0.50			
Max steptrack std [db]	0.20			
Use solutions	Enabled			

NON-GEOSYNCHRONOUS SUPPORT PARAMETERS				
PARAMETER	**DEFAULT**	**TARGET 1**	**TARGET 2**	**TARGET 3**
Non-geosynchronous tracking	Disabled			
Orbital period [seconds]	86164.09 seconds			
Orbital eccentricity	0.00000			
Orbit argument of perigee [deg]	0.000			

WARNING

This procedure will erase the ACU NVRAM database. This includes site data, antenna parameters, the target data base, and OPT solutions. Make sure the ACU parameters have been properly recorded in the preceding worksheet.

WARNING

This procedure must be performed with the system in STANDBY

and requires removing the CPU board from the unit.

All tracking operations must be halted prior to proceeding.

2. Place the ACU in **Standby** mode.

3. FLASH memory on the CPU30-Lite is protected by a DIP switch setting. To enable writing to FLASH memory it is necessary to access the CPU board, remove it from the VME rack and change a DIP switch. While handling the CPU boards use the anti-static mat connected to a ground point and to your wrist strap to safeguard against ESD damage. Use the following steps:

   a) Turn the ACU power OFF.
   b) Remove the top cover of the ACU chassis (or the Servo Control Unit on 7210 systems). With a wrist strap connected to a ground point, disconnect the cables connected to the front of the CPU board in order to allow removal of the CPU from the VME rack. It may be necessary to disconnect other cables to other boards in the same VME rack. Take care to note which cables are connected to each board and to which connector.

WARNING

If you are unfamiliar with the ACU, it is recommended that you mark each cable before disconnecting and take notes indicating which board and connector number it is connected to.

c) Remove the CPU board from the VME rack and locate DIP switch number 5, on the solder side of the printed circuit board (PCB). Set DIP switch SW5-4 to **OFF** to enable writing to FLASH memory.

NOTE
The silkscreen of the CPU-30Lite Rev4 describes the functions assigned to each DIP switch bank.

d) Reinsert the CPU board in the original slot in the VME rack; ensure it is well seated and reconnect the serial port cable to the screen (port 1).
e) It is not necessary to reconnect all the cables to other boards in the VME rack at this point; they can be reconnected after the upgrade is complete and the DIP switch 5-4 is returned to it's original position.
f) Turn the ACU power ON. Notice that since some cables are disconnected, the ACU will display several alarms; this is OK as long as the serial ports have been properly reconnected in order to complete this procedure.

4. Connect the PC or laptop RS-232 port to an RS-232 port (typically Port 3) on the CPU using the RS-232 Serial Communication Cable referenced in the **EQUIPMENT REQUIRED** section in this document. Typically, the 7200 ACU utilizes RS-422 on port 2 and RS-232 on port 3. 7205 and 7210 systems may have custom port configurations. **Port 1 is always reserved for the front panel console and should not be used.**

NOTE
On most laptops COM1: is the only available serial port (RS-232); if using a PC make sure to connect to the correct COM port.

Make sure the communications parameters in the terminal program match those of the ACU. The ACU communications parameters are found in the **Edit System configuration/Remote Port configuration** Menu. Recommended settings are:

Port = 3 (or 2), Baud = 38400, Parity = None, Data bits = 8, Stop bits = 1, Shell = MT M&C, Echo = Enabled, Newline = CRLF, Handshake = None and Screen lines = 20.

5. Confirm communications are working by pressing the **ENTER** key on the terminal program; the ACU should respond with a prompt '>'.

6. Further confirm that communications are working by entering the **HELP** command and verify that the ACU responds by sending the help screen text.

7. The FLASH memory is partitioned into four banks (0-3). Each FLASH bank is 1 Mbyte in size, therefore each bank may contain a complete ACU firmware image. FLASH bank 0 is programmed in factory by GDST and cannot be changed with this procedure. FLASH banks 1, 2 and 3 can be used for firmware upgrades.

8. Set the User Level of the ACU to Monitor mode. This is found under **Set User level (and Passwords)**... menu.

9. From the terminal program type:

   > **SU 0 <ENTER>**
   >

   This is a request for the M&C port to enter Supervisor mode. If your system uses a security password the **0** in the **SU** command will need to be replaced by the numeric password. Verify that you are in Supervisor mode by typing:

   > **WHO <ENTER>**
   >

10. Look at the FORCE CPU30Lite board inside the ACU chassis or inside the Servo Control Unit (SCU) in 7210 systems. Verify the position of rotary Switch 1 (mounted on the front edge of the board along with three 9-pin D connectors). The location of Switch 1 dictates which FLASH bank is used when the ACU boots up. When using the FLASH command in the next step **DO NOT** upload the new firmware into the current bank that is currently in use by the ACU. Doing so will cause the upload system to "crash," as the current software image will try to erase itself in preparation for the new image.

11. From the terminal program type:

    > **FLASH 1 <ENTER>**
    >

    The number 1 in this command is the FLASH bank you wish to program (i.e. you can use 2 or 3 as well).

12. The ACU will respond with "*Preparing for flash update.*" Then the ACU will erase the FLASH bank specified by the **FLASH** command in the previous step.

13. When the ACU has finished erasing the selected FLASH bank (this takes approximately 20 seconds), the ACU will then respond with "*Start XMODEM send.*"

14. Using the terminal program, send the file using a binary transfer using XMODEM protocol, with CRC checksums. For example, using Windows Terminal the XMODEM/CRC should be selected under the **Settings**/**Binary Transfers**... menus; and the image should be sent using the Transfers/Send Binary file...menu.

NOTE
The ACU sill be sending a "C" character to the terminal program about every 6 seconds. After sending 11 "C"s in the ACU will timeout on waiting for the upload and abort the process with the following message "Transfer Canceled!."

A sample session follows, including a timeout example:

```
>
>SU 0
>WHO Port 2 at supervisor
>FLASH 1
Preparing for flash update.
Start XMODEM send. CCCCCCCCCCC
Transfer canceled!
>FLASH 1
Preparing for flash update.
Flash updated.
>
```

NOTE
The FLASH command takes approximately 3-10 minutes to complete, depending on the baud rate used and the size of the binary image.

15. After the upload is complete, the ACU will return the message "*Flash Updated."* if the command was successful. Turn the ACU power OFF. Change rotary Switch 1 on the Force CPU30-Lite board to the number of the FLASH bank into which you downloaded the image (i.e. if you used a **FLASH 1** command turn the rotary switch to **1**).

16. Turn the ACU power ON.

17. To confirm this procedure was performed successfully and that the ACU is

using the correct firmware, simply view the firmware revision information provided in the **Display System Status… Firmware Version Information** screen.

18. Enable FLASH memory protection by returning DIP switch 5-4 to it's original position (ON). While handling the CPU boards use the anti-static mat connected to a ground point and to your wrist strap to safeguard against ESD damage. Use the following steps:

    a) Turn the ACU power OFF.
    b) With a wrist strap connected to a ground point, remove the CPU board from the VME rack and set DIP switch SW5-4 to **ON** to write-protect the FLASH memory.
    c) Reinsert the CPU board in the original slot in the VME rack; ensure it is well seated and reconnect the serial port cables.
    d) Reconnect all the cables to other boards in the VME rack at this point; take care to ensure all connections are reconnected in their original configuration.
    e) Turn the ACU power ON.

19. Reset the ACU to ROM defaults by **Edit System Configuration… Factory Tests… Reset ACU to ROM defaults.**

20. Enter all the user parameters previously recorded in the worksheet (page 4 and following).

20. The ACU firmware upgrade is complete.

Cosmetic Changes – Rev C	B. Tanner	9/1/10	D. Fredrickson	9/1/10	9722
Misc. Changes – Rev B	D. Baergen	9/6/00	W. Black	9/6/00	----
Original Release – Rev A	D. Baergen	10/23/98	W. Black	10/23/98	----
Rev. No/change	Revised By	Date	Approved By	Date	ECO#